

Department of the Interior  
U.S. Geological Survey

**LANDSAT 7 (L7)  
ENHANCED THEMATIC MAPPER PLUS (ETM+)  
RAW COMPUTER COMPATIBLE (RCC)  
DATA FORMAT CONTROL BOOK (DFCB)**

**Version 5.0**

**August 2005**



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## **Executive Summary**

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This Data Format Control Book (DFCB) provides the U.S. Geological Survey (USGS) and the Landsat 7 (L7) International Ground Stations (IGSs) with a clear and concise reference document to assist in the generation, archival, validation, and exchange of L7 Raw Computer Compatible (RCC) data.

This document is under the control of the Landsat Configuration Control Board (LCCB). Landsat Configuration Change Requests (LCCR) to this document, as well as supportive material justifying the proposed changes, should be submitted to the Mission Management Office (MMO) located at the USGS Center for Earth Resources Observation and Science (EROS) near Sioux Falls, South Dakota.

## Document History

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## **Section 1    Raw Computer Compatible (RCC) Data Format**

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The RCC data format is comprised of wideband data downlinked from the L7 spacecraft and is stored on tape media. This format supports either a single or multiple L7 downlinks.

### **1.1    Wideband Data**

The L7 science payload data from the Enhanced Thematic Mapper Plus (ETM+) instrument is referred to as “wideband data.” Onboard the spacecraft, the image data, along with ancillary attitude and ephemeris data, are organized into two separate data stream formats. These formats are then multiplexed and transmitted to a ground receiving station over two Asynchronous Quadrature Phase Shift Keying (AQPSK) 75Mbps (I & Q) channels. Within the I and Q downlink channels are contained two data “Formats.” Format 1 contains ETM+ image bands 1 through 6L, and format 2 contains bands 6H, 7, and the panchromatic band (band 8).

For the purposes of generating the L7 archive and exchange format, it is necessary to de-interleave the bit streams for the two channels and provide the channels in two separate data files in a computer compatible byte format. If an International Ground Station collects and archives their raw data in an interleaved (multiplexed) format, the two channels must be de-interleaved (demultiplexed) when the data is provided to the USGS. Although the serial data must be de-interleaved, it does not have to be byte-aligned. When reconstructing the serial data stream, the data must conform to the specifications of the L7 System Data Format Control Book (DFCB) Volume IV – Wideband Data (Reference Document 2).

### **1.2    Writing RCC Data to Tape Media**

#### **1.2.1    Single L7 Downlink**

Each L7 downlink results in the generation of two data files—one containing the I channel data and the other containing the Q channel data. When these two files are written to tape, each file is written using the GNU tar command. A single L7 downlink, written to tape media, will consist of two separate tar files—not a single tar file containing both data files. The following example illustrates the GNU commands to write a single contact, containing two separate data files, to tape media:

I Channel File: `tar -cvf /dev/nstxx L7ET2002116140053EDC011I01.data`

Q Channel File: `tar -cvf /dev/nstxx L7ET2002116140053EDC011Q01.data`

These example commands will create each tar file for a single downlink and will not rewind the tape so that the second file can be appended to the tape media appropriately. See Section 2.1 for RCC file naming conventions.

### **1.2.2 Multiple L7 Downlinks**

When recording multiple downlinks to tape media, the single downlink process outlined previously shall be followed. After the first downlink is written to tape media, the second and any subsequent downlinks shall be written to tape using the GNU tar command sequence specified for a single downlink. For example, five separate downlinks, when written to tape, will result in ten separate tar files on the same tape media. Each downlink, consisting of an I and Q channel tar file pair, must be contained on a single tape. Also, spanning data file pairs across multiple tapes is not permitted. See Section 2.1 for RCC file naming conventions.



## Section 2 Media Formatting

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This section outlines the RCC data file naming convention.

### 2.1 RCC Data File Naming Convention

The raw computer compatible data file naming convention is as follows:

**VNIMYYYYDOYHHMMSSGSICDIAVV.data**

Table 2-1 outlines the parameters that comprise the raw computer compatible file naming convention. All parameters for a given downlink's data file pair must be identical except for the "AQPSK Channel" identifier (I or Q). The AQPSK Channel identifier must be different for a given downlink's data file pair. For an example, see Section 2.2.

Parameter	Filename Positions	Description
Vehicle Series	V	"L" for Landsat.
Vehicle Number	N	"7" for Landsat 7.
Instrument	I	"E" for ETM+.
Sensor Mode	M	"M" Reserved for sensors with multiple operating modes. Use "T" for Landsat 7.
Year	YYYY	The year that the ETM+ data were downlinked by the L7 spacecraft.
Day of Year	DOY	Julian day of year that the ETM+ data were downlinked by the L7 spacecraft.
Hour	HH	Greenwich Mean Time (GMT) hour of day that the ETM+ data were downlinked by the L7 spacecraft.
Minute	MM	Minute of hour the ETM+ data were downlinked by the L7 spacecraft.
Second	SS	Second of the minute the ETM+ data were downlinked by the L7 spacecraft.
Ground Station Identifier	GSI	Ground station identifier of the station the L7 spacecraft downlinked the ETM+ data to.
Capture Device Identifier	CDI	<p>"C" = Alpha or numeric character.  "D" = Alpha or numeric character.  "I" = Either an alpha or numeric character may be used for stations receiving single downlinks. Stations receiving dual downlinks shall ensure the "I" position is a unique numeric character (0-9).</p> <p>The CDI for a given I and Q channel file pair must be identical.</p>
AQPSK Channel	A	Channel identifier – either "I" or "Q". Unique identifier for two corresponding files.
VV	Version	<p>2-digit file version number (starting with 01).</p> <p>Any ground station not participating in versioning data will always use 00.</p>
.data	.data	"data" = File extension for the raw wideband data in binary format. Required.

**Table 2-1. Raw Computer Compatible Data File Naming Convention Parameters**

## 2.2 Example RCC File Names

The contents of the transmittal tape media containing a single downlink should resemble the following for an IGS not using file versioning.

<u>RCC File Name</u>	<u>File size in bytes</u>
L7ET2001116140053DKI012I00.data	6165626880
L7ET2001116140053DKI012Q00.data	6165626880

The contents of the transmittal tape media containing three separate downlinks should resemble the following. Note: File sizes may differ slightly between the I and the Q channels.

<u>RCC File Name</u>	<u>File size in bytes</u>
L7ET2001214123458EDC011I02.data	6249512960
L7ET2001214123458EDC011Q02.data	6248437920
L7ET2002116140053EDC012I01.data	3165626880
L7ET2002116140053EDC012Q01.data	3165626880
L7ET2003120142515HIT011I00.data	5918162944
L7ET2003120142515HIT011Q00.data	5918162944

## **Section 3    LAM RCC Products**

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LAM RCC products are available on Digital Linear Tape (DLT) media or through transfer methods outlined in this section. End users can get products through the LAM/PDS distribution system. The parameters outlined are intended to ensure end user products from different distribution systems are similar.

### **3.1    Digital Linear Tape (DLT)**

Data products may be supplied on DLT. This includes a family of devices and media including DLT-IV, DLT8000, and SDLT. At this time, DLT-IV devices (DLT4000 and DLT-7000) are no longer available from vendors. There are, however, a large number of existing DLT-IV devices in use. New tape devices include DLT8000 and Super DLT (SDLT). Both are “read compatible” with media written using DLT-IV devices.

Data is written using the Tape Archive (TAR) utility format (per IEEE POSIX standard 1003.1), thus preserving directory structure and file names. The no-swap device and a fixed blocking factor of 256 512-byte blocks are used to maximize portability between platforms.

The root directory must contain a set of files or subdirectories. Depending on the distribution technique, orders with only one scene may place all files in the root directory. However, if there are multiple scene units, there must be one subdirectory for each product ordered. Product subdirectories are labeled with a unique name. All of the files associated with a product exist at a common level within the product subdirectory.

Product orders with large scenes or a number of scene units may exceed the capacity of the media. If this occurs, distribution systems span scene units across multiple volumes; a copy of the HDF directory file is included on all output volumes for user convenience.

The DLT tape label will include the following information: Mission indicator (which is L7 or Landsat 7), product type (which is RCC), the DLT format (ex: DLT4000, DLT7000, DLT8000, SDLT), the type of TAR used (ex: IRIX, GNU), and the blocking factor.

### **3.2    Electronic File Transfer Protocol (FTP)**

Electronic data transfer uses FTP. FTP, as described in RFC 959, is an internet standard for file transfers that supports retrieval of files from a remote server. This distribution method may not be available to all end users by all distribution systems. In some cases special high-speed network requirements must be arranged. Various strategies and procedures to access data may vary significantly between distribution systems.

When FTP service is available, data will be stored using the following standard. The home or initial login directory contains a set of files or subdirectories. Depending on the distribution technique, orders with only one scene may place all files in the home directory. However, if there are multiple scene units, there must be one subdirectory for

each product ordered. The product subdirectories are labeled with a unique name. All of the files associated with a product exist at a common level within the product subdirectory.

## **Appendix A    Abbreviations and Acronyms**

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AQPSK	Asynchronous Quadrature Phase Shift Keying
CDI	Capture Device Identifier
DFCB	Data Format Control Book
DLT	Digital Linear Tape
EROS	Earth Resources Observation and Science
ETM+	Enhanced Thematic Mapper Plus
FTP	File Transfer Protocol
GMT	Greenwich Mean Time
GSI	Ground Station Identifier
I	I Channel
IGS	International Ground Station
L7	Landsat 7
LCCB	Landsat Configuration Control Board
LCCR	Landsat Configuration Change Request
Mbps	Megabits per second
MMO	Mission Management Office
MOU	Memorandum Of Understanding
RCC	Raw Computer Compatible
SDLT	Super DLT
Q	Q Channel
TAR	Tape Archive
USGS	UnitedStates Geological Survey

## References

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Memorandum of Understanding (MOU) Between the US Government and International Cooperator for the Direct Reception and Distribution of Landsat 7 Data.  
<http://landsat.usgs.gov/resource.html>

NASA/GSFC, LS-DFCB-18, Landsat 7 System Data Format Control Book (DFCB)  
Volume IV – Wideband Data, Revision L, 11 June 1999.

USGS/EROS, LS-PD-52, Landsat 7 (L7) Enhanced Thematic Mapper Plus (ETM+)  
Data Validation and Exchange Implementation Plan, Version 1.0, June 2005.